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Attorney Docket No. 60896 (70551)
Application Ser. No. 10/787,037
Applicant: A. Sugiyama

Examiner: Karla A. Moore
Art Unit: 1763

REMARKS

This is in response to the Office Action dated December 21, 2006, designated as non-final, and currently outstanding with respect to the above-identified application. Claims 1, and 3-12 were pending at the time of issuance of the currently outstanding Office Action. The Office Action rejects claims 1, 3-6, and 8-12. The Office Action also objects to claim 7 as being dependent upon a rejected base claim (claim 1), and objects to claim 3 because it depends from canceled claim 2. Claim 1 is hereby amended to more particularly point out and distinctly claim the subject matter that the Applicants regard as the invention. Claim 3 is hereby amended to properly depend from claim 1. No new matter has been added.

Support for the amendment to claim 1 can be found throughout the specification and claims as originally filed. In particular, support for the amendment to claim 1 can be found at least, for example, in the Specification in Figures 1, 5, 6, 10, 11, 12 and 13. Because the space between the electrodes is completely filled with dielectric, plasma cannot form there, as pointed out, for example, at page 4, lines 23-25. The amendment of claim 1 herein is not to be construed as acquiescence to the rejection set forth in the present Office Action, and was done solely to expedite prosecution of the present application. The Applicants hereby reserve the right to prosecute the claims as originally filed, or similar claims, in one or more continuation or divisional applications.

In view of the present amendments and remarks, the Applicants respectfully request reconsideration of the above-identified application. The Applicants respectfully submit that the application is patentably distinguishable over the art relied upon by the Examiner, and that all claims are now in condition for allowance. Should the Examiner disagree, the Applicants respectfully request the Examiner to contact their undersigned representative by telephone so that an interview may be scheduled prior to the mailing of any final Office Action.

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Claim Rejections- 35 U.S.C. § 103(a)

Claims 1, 3-6 and 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Publication No. 2005/027945 A1 to Okumura et al. in view of U.S. Patent 5,549,780 to Koinuma et al. and Japanese Patent Publication No. 2002-151494A to Yara et al. The Applicants traverse the Examiner's rejection of claim 1, particularly as herein amended, and the rejections of claims 3-6 and 8-11, because none of the cited references teaches or suggests, alone or in combination, the plasma generating apparatus as claimed in any of the present claims.

Claim 1

The Examiner cites Figures 1-2 and 22, and paragraphs 149 and 157 of Okumura et al. as disclosing

... first (13) and second electrodes (14) adjacent to each other and facing a surface of the object (11) to be processed; a dielectric (1 and 2) having a first opposing surface (1) positioned spaced apart from the surface of the object and a second opposing surface (2) positioned spaced apart from the surface of the object, filled between said first and second electrodes; gas supplying means (Figure 22; paragraphs 149 and 157) provided inside said first electrode having a supply opening formed in said first opposing surface for supplying the process gas to the surface of the object through said supply opening; and gas exhausting means (see paragraphs 149 and 157) provided inside said second electrode having an exhaust opening formed in said second opposing surface for exhausting the processing gas supplied to the surface of the object through said exhaust opening.

The Examiner states that although Okumura et al. fails to teach electrodes having coated surfaces, this element is provided by the Koinuma et al. reference. In addition, the Examiner cites Yara et al. for teaching that a dielectric can be provided between a first or second electrode and the surface of an object to be processed.

Nothing in any of the references suggests their combination in such a way that the space between the electrodes is filled with dielectric, so that no plasma can be generated between the electrodes. Combining these references with Okumura et al., would not in fact result in a plasma processing apparatus in which a dielectric completely fills the volume between the electrodes, as

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recited in amended claim 1 of the instant application. Referring to Figures 1-2 and 22 of Okumura et al., the dielectric material (1) and (2) does not completely fill the space between electrodes (13) and (14). Therefore plasma can form in the space (3) between the electrodes of Okumura et al.

Moreover, the failure of Okumura et al. to disclose the complete interposition of dielectric between the electrodes is not cured by either or both of Koinuma et al. or Yara et al. Referring to Figure 1 of Koinuma et al, a gap is present between the central conductor (11) and the outside conductor (12). Plasma-forming gas flows within that space. Furthermore, Figure 3 of Yara et al. shows that there is a space between electrodes (2) and (3) through which the processing gas also flows. In these cases, plasma processing efficiency is suboptimal because plasma is generated in a region that is removed from where the plasma processing occurs. In contrast, the Applicant's invention increases plasma processing efficiency because the plasma generation site is the plasma processing site. This allows the substrate to be exposed to more intense plasma for any given amount of energy used to generate it. It also prevents jets of plasma generated between electrodes from impinging the surface being treated in a perpendicular direction, thus improving the quality of the treated surface. None of the cited references, either alone or in combination, teach or suggest the invention as recited in amended claim 1. Therefore, the Applicants respectfully request reconsideration and allowance of claim 1 as herein amended.

Claims 3 – 6 and 8 – 11

The Applicants request reconsideration and allowance of amended claims 3 – 6 and 8 – 11. Those claims depend from amended claim 1, recite further limitations of the structure recited in amended claim 1, and are thus allowable on that basis. Without acquiescing to the Examiner's interpretation of these claims in light of Okumura et al., the Applicants nevertheless point out that neither Okumura et al. nor the other references teach or suggest a plasma processing apparatus in which a dielectric completely fills the volume between the electrodes, as recited in amended claim 1 of the instant application. Therefore, none of these claims would have been rendered obvious in light of the references cited.

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Claim 9

The Applicants respectfully traverse the rejection of claim 9. The Examiner cites paragraph 158 of Okumura et al. to reject claim 9, suggesting that the general conditions of claim 9 are disclosed in Okumura et al., and stating that

Okumura et al. teach that it is ideal to design the gas supplying means and said gas exhausting means so that gas supplied through the gas supplying means is exhausted through the gas exhausting means in order to make it possible to prevent plasma processing from being carried out in a wide range portion beyond the area where plasma processing is desired (paragraph 158).

Okumura et al. discloses that if 70% or more of the supplied gas is exhausted through the gas exhaust outlet 90, then plasma processing outside the desired "fine linear portion 15" can be prevented. (Paragraph 0158). Claim 9 of the instant application requires that the total flow rate of gas exhausted through the exhaust opening is *not smaller* than the total flow rate of the processing gas supplied through the supply opening. This limitation differs from Okumura et al., because, among other reasons, it allows the device to operate without the need "to blow an inert gas or the like toward the surface of the object in order to protect the object from contaminating atmosphere. Therefore, the apparatus can be made smaller and the cost of the gas used for the apparatus can be reduced." (Specification, p. 6, ll. 28-31). Neither Okumura et al. nor the other references cited teach or suggest the desirability of this feature.

Okumura et al. does not teach or suggest a plasma processing apparatus in which a dielectric completely fills the volume between the electrodes, as recited in amended claim 1 of the instant application. Claim 9 is patentable over the prior art at least for that reason. Therefore, the Applicants request reconsideration and allowance of claim 9, because it would not have been rendered obvious in light of any of the references cited.

Claim 10

The Examiner states that "each of the relied upon references clearly teaches that processing characteristics can be customized by tailoring the electrode configuration (e.g. Yara et al. at paragraphs 71 of JPO translation)." The Applicants respectfully disagree. The exhausting

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of the gas via the second electrode as recited in amended claim 1 is not taught by any of the references, including Okumura et al. The relative geometries of the electrodes as recited in claim 10 provide a further refinement of this inventive feature (see, for example, Specification p. 7, ll. 6-12). Furthermore, Okumura et al. does not teach or suggest a plasma processing apparatus in which a dielectric completely fills the volume between the electrodes, as recited in amended claim 1 of the instant application. Claim 10 is patentable over the prior art at least for that reason. Therefore, the Applicants request reconsideration and allowance of claim 10, because it was not rendered obvious in light of any of the references cited.

Claim 12

The Examiner rejects claim 12 under 35 U.S.C. 103(a) as being unpatentable over Okumura et al., Koinuma et al. and Yara et al. as applied to claims 1, 3-6 and 8-11, and further in view of Japanese Patent No. 2001103199 A to Nakamura et al. (The Applicants note that the correct reference to Nakamura et al. is Japanese Patent Publication No. 2001-102199, entitled "Plasma Treatment Apparatus and Method Therefor.") The Examiner states that it would have been obvious to one of ordinary skill in the art at the time the Applicant's invention was made to have provided a third electrode in Okumura et al., Koinuma et al. and Yara et al. in order to provide a lengthened plasma space for a conveyed substrate as taught by Nakamura et al." The Applicants traverse this rejection, and request reconsideration and allowance of claim 12.

Considering the Examiner's comments in light of this reference, while the three-electrode arrangement of claim 12 does provide a lengthened plasma generation space, the arrangement of the electrode polarities is neither taught nor suggested by any combination of the cited references. Positioning the second electrode of one polarity between the first and third electrodes of the opposite polarity provides unique advantages, including, for example, the fact that in a "plasma processing apparatus structured in this manner, electric fields formed externally by the first, second and third electrodes cancel each other. Therefore a safer plasma processing apparatus can be provided." (Specification p. 7, lines 22-25)

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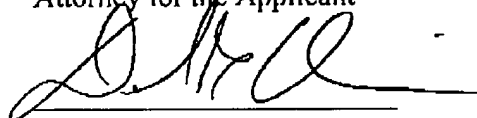
Furthermore, Okumura et al. does not teach or suggest a plasma processing apparatus in which a dielectric completely fills the volume between the electrodes, as recited in amended claim 1 of the instant application. Claim 12 is patentable over the prior art at least for that reason.

CONCLUSION

In view of the foregoing amendments and remarks, favorable reconsideration and withdrawal of all rejections, and allowance of this application with claim 1 and claim 3 as amended are respectfully solicited. Should any of the claims not be found to be allowable, the Applicants respectfully request the Examiner to telephone their undersigned representative at the number below so that a telephonic interview may be scheduled. The Applicants thank the Examiner in advance for this courtesy.

Respectfully submitted,
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